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SCIENCE

NEW YORK, AUGUST 25, 1893.

AN EXHIBIT OF RELIGIONS.

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IN the month of September there is to take place in Chicago an event which promises to be epoch-making in the history of religions, and perhaps, by its ultimate consequences, in the general history of mankind. I refer to the World's Parliament of Religions, at which the representatives of the Catholic, Oriental and Protestant forms of Christianity, with their various sub-divisions, will meet on equal terms with those of the different sects of Judaism, Mohammedanism, Hinduism, Buddhism, Jainism, Parseeism, Confucianism, Taoism, Shintoism, and other non-christian systems.

These religious bodies will present to the Parliament, through their accredited representatives, a statement of their teachings, practices and claims, and many of them will also have special congresses of their own, in which their doctrines, histories and practical methods will be still more fully exhibited.

It is believed by many of the friends and participants of the parliament that it cannot fail to give rise to a mutual understanding and appreciation between the world's religions, altogether unprecedented in the past, and that it will result in a vast increase in the spirit of human brotherhood, the lack of which has been the cause of many of the darkest chapters of history, and has constituted the greatest of all obstacles to the progress of the race.

But it is to its scientific, rather than to its religious or social value, that I wish to call attention. Although many of the foremost European and American specialists in comparative religion have prepared papers for the congress, or promised their personal attendance, the attention of the scientific world at large has not yet been sufficiently drawn to the extraordinary opportunities which it will present to serious and disinterested students.

It is true that it is in no sense a scientific congress, although several of its sessions will be devoted to the scientific view of religions, and these will be participated in by men of world-wide fame as the very foremost representatives of hierological science—men like Müller, Tiele, d'Alviella, Harding and the Révilles. It is true that the religious bodies participating have at heart, in most cases, the interests of their own propaganda; they hope to make so favorable a representation of their own special systems as to break down any prejudices of which they may be the objects, and to attract at least the respectful interest, if not the adhesion, of many of those who hear them.

But these facts, so far from decreasing the scientific value of the parliament, are really its essential conditions. It is a truism to say that the collection of materials is the most important part of any inductive science, since the science can be genuine and its results definitive only so far as its basis of observed facts is broad and adequate. Now there is no existing science in which more still remains to be done in the collection of materials than in comparative religion.

Many hurried inductions have been made on the basis of a few ill-observed and ill-assorted facts recorded by missionaries and travellers, whose opportunities, training, or habits of mind, have not fitted them for collecting thoroughly authentic data. Only a small proportion of the sacred books of the world have thus far been translated by European scholars and placed within the reach of the student; and these books can have but a partial and preliminary value so long as the complicated systems which have produced them, or grown out of them, have not been studied in the details of their historical development, subdivision, reproduction, inter-action and fusion.

What does European scholarship know, for example, about the religious development of India, in spite of the vast amount of good work which has been done in that field by Vedic scholars, general philologists, and other classes of students? There exists to this day but one professedly original résumé (and that very imperfect, and based to a large extent upon a native work) of the *existing sects* of Hinduism, and from this all other descriptions have been, for the most part, copied or abstracted.

Who is there, even among professional Indianists, who is thoroughly acquainted with the various ramifications of either Vaishnava, 'Saiva or 'Saktî Hinduism, the dates and circumstances of origin of the sects into which they are divided, the minutiæ and sources of their doctrinal and practical differences, and their relative dependence upon ancient Vedic or non-Vedic Aryan religion, the pre-Aryan cults of Bactria and India, Mohammedan and Christian influences, the old and new philosophical schools, and internal processes of corruption and decay or of constructive or agglutinative development?

Again, every competent student of religions knows how difficult it is to catch the exact flavor or spirit of Oriental, or even of savage thought, and how, almost inevitably, it receives a certain foreign coloring whenever it is transmitted through a cultivated Occidental brain. Thus far very few descriptions of the non-christian religious sects of the East, written by native adherents of those religions, have been obtainable.

It is to be further noted that those students of hierology who approach the subject from the philological standpoint, are apt to pay too much attention to the terminology of religions and to their archaic literary monuments (which sometimes represent ideal systems that have never been actually carried out to any great extent) rather than to the successive transformations of their popular and pragmatic forms, the study of which is really as much more important as it is more difficult.

On the other hand, those whose primary interest is ethnological, are equally prone to consider, even in the more advanced religions, the *paraphernalia* of the cult and the *media* of doctrine, to the detriment of the theories and *Weltanschauungen* themselves, which form, in every case, the soul of the system.

The science of religions can never rise above the level of an empty empiricism, and no definitive results can be attained in it, until every class of religious facts shall be recorded with absolute impartiality, and religions studied as a whole—their doctrines, philosophies, spiritual and moral disciplines, biblical and liturgical constructions, sacramental and ceremonial systems, organization and functional specialization, methods of instruction and propaganda, and fortuitous non-religious ingredients, with due distinctions between the official and popular elements, and, whenever they have an ascertainable history, in an exact chronological order. A dogma is as acceptable a datum for the science of religions as a myth,

or an altar-stone, or a ceremonial mask, and the religions that are nearest us are no less in importance than those that are remotest. Every one who is cognizant of the universality of law must recognize that all the changes in the recent religious life of Christendom, for example, are subject to the same laws of religious evolution and dissolution that have governed the whole religious history of the globe.

If these allegations are correct, a collection in which all the principal religions of the Christian and non-Christian world are presented in the way in which they are understood and practised by their own followers, must be of incalculable value, bringing together an enormous body of materials, such as could not have been collected by individual enterprise, even at the cost of years of labor and observation.

Were it an exclusively scientific assemblage, it would not be the vast repository of data which it is to be, and it could do nothing else than to further the breeding in and in, as it were, of scientific thought and speculation on a line where a vastly enlarged field for induction is the chief desideratum.

The proceedings of the parliament will form an invaluable addition to the materials for the study of religions, but as many as possible of those who take a scientific interest, in the subject, should attend the parliament in person, so that they may in face-to-face intercourse with the picked representatives of the Christian, Jewish, Moslem and pagan sects and sub-sects, if not by their action in the great congress itself, bring out and note for their own use, and the future uses of science, the many facts which will otherwise fail to be collected.

NOTES AND NEWS.

The following are the officers of the American Association for the Advancement of Science elected for the ensuing year: President, Daniel G. Brinton, Media, Pa.; Vice-Presidents—Section of Mathematics and Astronomy, George C. Comstock, Madison; physics, Wm. A. Rogers, Waterville, Me.; chemistry, T. H. Norton, Cincinnati, O.; mechanical science and engineering, Mansfield Merriman, South Bethlehem, Pa.; geology and geography, Samuel Calvin, Iowa City, Ia.; zoölogy, Samuel H. Scudder, Cambridge, Mass.; botany, L. M. Underwood, Greencastle, Ind.; anthropology, Franz Boas, Worcester, Mass.; economic science and statistics, Harry Farquhar, Washington, D. C.; Permanent Secretary, F. W. Putnam, Cambridge, Mass. (re-elected); General Secretary, H. L. Fairchild, Rochester, N. Y.; Secretary of the Council, James L. Howe, Louisville, Ky. Secretaries of the Sections—Mathematics and astronomy, W. W. Beeman, Ann Arbor, Mich.; physics, B. W. Snow, Madison; chemistry, S. M. Babcock, Madison; mechanical science and engineering, J. H. Kinealy, St. Louis, Mo.; geology and geography, Wm. H. Davis, Cambridge, Mass.; zoölogy, Wm. Libbey, Princeton, N. J.; botany, C. R. Barnes, Madison; anthropology, A. F. Chamberlin, Worcester, Mass.; economic science and statistics, Manly Miles, Lansing, Mich. Treasurer—Wm. Lily, Mauch Chunk, Pa. (re-elected.) Considerable discussion has taken place in relation to the place of meeting for 1894, but it is still undecided. Boston and Worcester, Mass., Providence, R. I., and Brooklyn, N. Y., have all been referred to, but the matter is left in the hands of the President and the Permanent Secretary for decision. San Francisco is spoken of as the place for meeting in 1895, and an invitation has been received from Nashville, for 1896.

—The U. S. Bureau of Education has issued a large paper-covered volume on "Benjamin Franklin and the University of Pennsylvania." It is edited by Francis N. Thorpe, professor of American constitutional history in the university, and the part directly relating to Franklin and his views upon education is written by Mr. Thorpe. He begins with an account of Franklin's own self-education, the Autobiography being mainly drawn upon as authority, and Mr. Thorpe expresses the opinion that "the influence of Franklin on American education has been even greater through his Autobiography than through the institutions which he founded, or which were founded by his followers." The movements that led to the establishment, in 1749, of the Public Academy of Philadelphia, the patent of the present university, are carefully recorded, and several important documents relating to its history are presented, including the circular by Franklin, in which he proposed its establishment and also the constitution of the academy itself. A chapter is then given to setting forth Franklin's ideas on education, followed by a comparison of his views with those of his eminent contemporaries, Adams and Jefferson. Franklin's theory of education was utilitarian, though not in the narrow, materialistic sense, and the University of Pennsylvania still shows, in its organization and its general spirit, the influence of his ideas. Rather more than half the present volume is devoted to a sketch of the university itself, the different departments of the subject being treated by different writers, a mode of treatment which makes the sketch rather scrappy, but gives, nevertheless, a fairly intelligible account of the institution. At the present time the number of students in the various medical and physiological departments outnumber all the rest, but there has been a movement at work for some years to broaden the scope of the university, and this movement, which has already led to the establishment of several new departments, gives promise of still better results in the future.

—The subjects to be brought before the International Congress of Anthropology, to be held at Chicago during the week beginning August 28, will be taken in the following order: Monday, Presidential Address, Physical Anthropology; Tuesday, Archæology; Wednesday, Ethnology; Thursday, Folk-Lore; Friday, Religions; Saturday, Linguistics. The morning proceedings will take place at the Memorial Art Palace, Michigan avenue and Adams street, and will commence each day at 9 A. M. At noon the meeting will adjourn for an afternoon session to be held at Jackson Park, at 2 P. M. At the afternoon meetings the papers to be read will have special reference to the anthropological exhibits at the Columbian Exposition, particularly those in the Anthropological Building, the U. S. Government Building, the foreign government buildings and the Midway Plaisance. It is proposed to visit the exhibits, after the reading of the papers, for inspection of the objects referred to. The following is the afternoon programme: Monday, Anthropological Laboratories; Tuesday, Folk-Lore; Wednesday, U. S. Government and Smithsonian Exhibits, Government Building; Thursday, American Archæology; Friday, Ethnology; Saturday, Ethnological Exhibits of Foreign Governments. The Midway Plaisance. The proceedings of the congress will be published in due course, and will consist of such papers, in full or in abstract, as shall have been formally presented to the congress, and be recommended for publication by a committee appointed for that purpose. A subscription of five dollars ($5.00) will entitle the subscriber to a copy of the volume to be published. Address all communications: Mr. C. Staniland Wake, Local Secretary, Department of Ethnology, World's Columbian Exposition, Chicago.

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Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

A GEOLOGICAL SKETCH, WITH NOTES ON THE GEOLOGY OF THE MANITOU ISLANDS OF LAKE NIPISSING, ONTARIO.

BY J. M. GOODWILLIE, OTTAWA, CANADA.

GEOLOGY is that particular branch of scientific study which treats of the history of the earth; its organization and structure, the materials of which it is composed and the various processes by which it has attained its present constitution.

The term Geology is derived from two Greek words: ge, the earth, and logos, a history or description.

As history, we must consider it apart from the records of human action and human progress,—a history disclosed to us by the record and study of the rock masses which lie around us and beneath us, and by comparing the results of the natural phenomena of the past with the numerous forces and agencies at present in operation, in modifying the surface of the globe.

By the term *rock*, in geology, is not to be understood merely that hard material which we commonly call stone, but it is employed to include everything of which the earth's crust is composed. The sand and gravel of our lake shores, the clays employed in the manufacture of brick and earthenware, the limestone and marble and sandstone of our provincial quarries, the pebbles and bowlders by the roadside, and the soil of which our gardens and farms are composed are all, geologically speaking, rock, equally with the granite of our hills and mountains.

The determination of the materials of which rocks are composed belongs to the department of mineralogy and which, although not identical with geology, is closely allied to it.

Geology endeavors to account for the rock masses and various materials of which the earth is constructed. It aims at answering the enquiry, how have these things been formed and what are the processes by which they exist? Mineralogy examines into the nature and character of the materials, and analyzes and resolves into its component parts the various ingredients of which a rock is composed.

The study of geology reveals the fact almost everywhere patent in our surroundings, that we live in the midst of a rocky area, which upon investigation, proves to belong to the oldest known rocks in existence, and forms what we might term the foundation stones of the superstructure of our world.

Mineralogy shows us what the rocks contain, whether iron, or copper, or galena, or nickel, or silver, or gold, or platinum, and the modes of their occurrence; so that by a careful study of the conditions in which they are usually found, the investigator and prospector may be saved much unnecessary expenditure of time and labor in searching after the concealed wealth which lies hidden from the easy observation of man.

Geology does not attempt to account for the origin of the world, but the careful study of it gives us the only intelligible solution that can be entertained of the causes which must have operated in producing its present appearance, and the diversity everywhere apparent in its structure.

To a higher than any human source must we look for an answer to the inquiry into the origin of the world. In the sublime and indisputable declaration with which the book of Divine Revelation opens, there is given us the only satisfactory answer that can anywhere be found and which must forever prove sufficient, not only as it relates to this terrestrial sphere, but also to the universe of unenumerated worlds of which this earth is, comparatively speaking, only an insignificant part: "In the beginning God created the heavens and the earth."

In that opening announcement of the book of God we are not only carried back to an indefinite, and it might be said an almost unlimited period, but we are also reminded that He who by his own almighty word "spake and it was done," and "commanded and it stood fast," did not then create the world as it at present exists. We are reminded that there was a time when the earth was without a human inhabitant, when no rain had yet fallen upon it, and when "there was not a man to till the ground." There was a time, further back, when our forests were uninhabited by wild beasts, and our marshes and lowlands untenanted by the almost numberless creeping things which make these resorts their abode. There was a time, still further back, when our streams and lakes and seas were without inhabitant, when there were no monarchs of the deep to engage in bloody encounters, and contest with each other the right of occupancy, and when there was no fowl of any kind to fly in the heavens, nor songsters to awaken the morning with notes of rejoicing and triumph.

There was a time, yet more distant, when the earth was destitute of vegetation of any kind, when no forests clothed our hills and mountains, when no grasses grew upon our plains, nor made verdant the valleys of our water courses, and when herbs, and fruits and flowers had not yet begun an existence preparatory to the introduction of animals and of man in particular.

There was a time, still more remote, when no mountain chains existed, with here and there lofty peaks penetrating the clouds and towering high towards heaven, and when there were no hills with accompanying valleys hollowed out among them.

There was a time, more distant still, when the earth appeared as one vast expanse of boundless sea, when islands and continents had not appeared above the surface of the great and mighty ocean, when "darkness was upon the face of the deep," and when, in all the illimitable dreary waste of waters, life and animation were entirely unknown.

Step by step the Creator was gradually preparing the earth to be the residence of the human race. Slowly and deliberately He brought about the necessary changes, all of whose workings are particularly distinguished by the absence of that spirit of haste and restless impatience so commonly manifested in the undertakings of man.

The time occupied in bringing about the present condition of things, as apparent throughout the world, must have been an indefinitely long period. Sacred science,

as held and interpreted by the early Fathers, taught that the world was of a comparatively recent origin, and did not date beyond four or five thousand years before the Christian era, and that the time occupied in the act of creation comprised six ordinary days.

Geological investigation, however, constrains us to assign to the earth an antiquity much more remote than the six or seven thousand years which it is commonly supposed to have existed, and to give to the several stages which marked its gradual development a limit beyond the twenty-four hours included in each of the successive days of creation.

It is impossible, however, for us to arrive at any definite conclusion as to the age of the world. Scientists, anxious and zealous in the maintenance of truth, differ among themselves as to the exact time occupied in the various modifications which the world must necessarily have undergone previous to its being occupied as the temporary abode of man. Instead of a few thousand, the space included comprises tens of thousands of years; some estimating the time at fifty thousand, others at two hundred and fifty thousand, and half a million of years as being necessary to the production of the present condition of things. But in one particular they all agree, and unite in giving to the earth a place in history many thousands of years anterior to the creation of man.

The rocks of which the earth's crust is composed are divided into 1st, igneous, or eruptive and unstratified rocks, and 2d, aqueous, or sedimentary and stratified rocks.

A third division is sometimes made and designated as metamorphic rocks, or rocks of a stratified crystalline formation. which in reality are only sedimentary rocks which have been changed by the action of steam or heat without destroying their stratified appearance.

By far the largest proportion of the earth's crust with which the geologist has to do is composed of aqueous or sedimentary and stratified rocks, and to the study of these, principally, must we look for those facts and data which, without doubt, prove our world to have a history of very great and undetermined antiquity.

By the crust of the earth is to be understood the materials of these several great sub-divisions of which the earth's surface is composed. It is by no means to be regarded as a solid mass throughout. Different theories have been advanced by scientists in reference to the internal condition of the earth. Some consider the centre of the earth to be composed of rock matter solidified by pressure with liquid fiery matter between this central area and the crust on the surface.

Others regard the earth as more or less solid, with lakes and seas of fire internally alternating throughout, while many others, and the commonly received opinion, hold that beneath the surface, of which we are accustomed to speak as the crust of the earth, and which extends to only a very limited depth, the whole of the internal portion of the earth consists of a molten sea of liquid fire.

The evidence in favor of this is confirmed by the following observations: In various parts of the world and at certain depths below the surface, an even temperature is found to exist throughout the year. At greater depths the temperature invariably increases, and although in all places it is not uniform, owing to the different kinds of rock penetrated, the average rate of increase is one degree for every sixty feet. And, as we may reasonably suppose the ratio to increase the greater the depth attained, we might expect comparatively soon to reach a temperature sufficiently high to sustain most minerals in a vaporous or molten condition.

Another evidence is found in the fact, that water brought at great depths from beneath the surface is found to possess a higher temperature than the temperature of the surrounding locality, and if the depth be extended the temperature of the water is increased with it.

Another and more convincing argument in proof of the molten condition of the interior of the earth is afforded us by the numerous volcanoes which occur throughout the world, some of which have been in active operation for hundreds, and even thousands, of years. They are generally regarded as constituting the principal channels of communication between the interior parts of the earth and the surface; and from unfathomable depths are more or less constantly pouring forth immense volumes of molten rock and liquid streams of living fire. More than two hundred and fifty volcanoes are now known at different times to be in a state of eruption, and many others have long since ceased to exhibit any degree of activity.

The thickness of the earth's crust has been variously estimated at from ten to twenty miles and upwards, but there is no means by which the exact depth of rock matter upon the surface can be accurately determined.

From the above considerations we are led to the conclusion that the interior of the earth consists of a mass of igneous incandescent matter, and which may have been, originally, the condition of the material now forming the crust of the earth, and that the gradual cooling of the surface by radiation, accompanied by the shrinkage and contraction attending the cooling process, together with the enormous pressure from within, produced immense crackings and bulgings of the earth's crust, which resulted in the many groups and chains of mountains, and associated valleys, to be seen upon the surface.

The rocks surrounding Lake Nipissing belong to the oldest known rocks in existence. They are the lowest and first in the order of sequence, and with but one exception, so far as is known, are almost entirely of an eruptive or metamorphic origin. They belong to the great Laurentian formation which extends over all the northern portions of the provinces of Quebec and Ontario, and continues west and northward to the Arctic Ocean. They are usually distinguished by their inclination at high angles, and by presenting in many places a variously folded and contorted appearance, and by the absence of organic remains. Here and there they are broken through by fragments and hugh masses of granite, which in some instances appear to have become the centres of eddies or whirlpools of molten rock. Some very interesting examples of these may be seen on the high, rocky portion crossed by McIntyre Street in the southeast part of the town of North Bay.

During some period of the world's history this whole region has undergone a most terrific convulsion of upheaval and depression, during which streams and lakes of fire appeared upon the surface, liquefying and changing the condition of the rock masses with which they came in contact.

To this same period, and to the operation of these same agencies, must we trace the origin of the extensive mineral deposits which occur throughout this northern region. The various metals being more fusible than the rock masses in general, found a ready exit in the cracks and fissures formed by the breaking of the earth's crust, and filling these became subsequently cooled, forming veins of various depths and thicknesses, and sometimes extending for miles in length, imparting to this part of our dominion, in outward appearance so uninviting, an attractiveness of wealth, in mineral resources, unrivalled, and perhaps it would not be an exaggeration to say, unequalled by any country in the world.

The rocks forming the second great sub-division into which the crust of the earth is divided are called aqueous, or sedimentary rocks. They are essentially formed by the ac-

tion of water, the strata or layers of which they are composed varying in composition and thickness according to the mineral character of the water and sediments, and the length of time engaged in forming them. They are readily distinguished from igneous, or eruptive rocks, by their horizontally stratified appearance, and by the occurrence of organic remains, of which some strata are almost wholly composed. These remains, which we commonly call fossils, comprise almost every variety of vegetable and animal life of the past, from the lowest fungus to the highest form of animate creation, including also many extinct species of both plants and animals, and which have no living representatives in the types and genera of the present day.

An examination into the nature and character of these fossil remains, both of vegetables and animals, which have inhabited the globe during the periods of its past history, constitutes the science of palæontology.

The sedimentary rocks, which enter so largely into the formation of the earth's surface, comprise a number of great divisions, distinguished by special and characteristic collections of plants and animals, and these again are further sub-divided, each sub-division having fossils peculiar to itself, and which may easily be recognized by those skilled in palæontology.

We shall have a clear understanding of the manner in which sedimentary rocks were formed by observing the various natural processes in operation at the present time in modifying the surface of the globe.

Sediments of various kinds, such as sand and gravel, and clays in solution, are constantly being carried down by streams and rivers and deposited on the bottom of lakes and seas.

Portions of banks and cliffs on the sea coast are continually breaking away, and, by the action of the water, disintegrated and spread over the bottom. The sediment deposited in this way is generally found to be disposed in horizontally arranged beds or layers, often enclosing shells and bones, weeds, leaves and branches from trees, and other organic bodies, drifted from the land or carried by the various streams into the sea. In process of time the sediments so deposited become solidified, partly by means of the calcareous and silicious matter contained in them, and that derived from the decomposition of the enclosed organic remains, and partly by the pressure of the superincumbent layers and strata of sedimentary matter.

In this and similar ways, all the stratified rocks on the surface of the globe have at different periods been built up, enclosing within the various formations the almost innumerable forms of vegetable and animal life peculiar to each successive period.

The time occupied in the deposition and solidifying of stratified rocks must necessarily have been enormously great.

It would not be an exaggeration to say that tens of thousands of years would be requisite to bring about the results which are so apparent in all our stratified rock formations.

The coast line of the Gulf of Mexico, at the mouth of the Mississippi River, has been known for more than three hundred years; and notwithstanding the immense alluvial deposits annually conveyed to the sea by that river and its tributaries for more than three centuries, comparatively little change has been made by the encroachment of the land upon the sea, and yet there was doubtless a time when the delta of the Mississippi was at St. Louis, nearly eight hundred miles from its present position.

Another and more forcible illustration may be seen in the various coal fields of the present day. They appear to have consisted, originally, of primeval forests, situated in low or marshy ground, which by a sinking of the earth's crust, or some similar natural phenomenon, gradually became submerged, and eventually covered with organic sediment of a vegetable kind, and in this condition have been gradually consolidated. In process of time fresh forests appear to have grown up, covering the same area, and in turn have in a like manner disappeared beneath the surface. In the coal-bearing strata of Nova Scotia, which have attained a thickness of 14,570 feet, no less than seventeen successive forests have been counted in less than one-third of that depth. Trees four feet in diameter have been found standing erect and almost entire, as they originally grew upon the surface. In the coal field of Sydney fifty-nine fossil forests have been distinctly traced, one above another.

When we take into consideration the time necessary to mature the growth of a forest, the gradual subsidence of the area on which it grew, until the whole was completely submerged, the filling up of the area with decomposed organic matter, the formation and growth of a second forest similar to its predecessor, and so on until fifty-nine such forests have matured and in turn disappeared, we can form some idea, though very vague at best, of the vast extent of time occupied in fitting up this world as an abode for man.

Again, when we consider that many stratified rocks lie hundreds and thousands of feet above the level of the sea, that the various strata of which they are composed abound in the fossilized remains of marine shells and animals, that there was a time when these same rocks must have formed the bed of the ocean, and the substratum of numerous other strata ages since abraded from their surface, not only will our conceptions of the length of time the earth has existed be greatly enlarged, but rightly considered, we shall also be led to adore the unsearchable wisdom and mighty power by which all these things were made.

A study of the geology of the Manitou Islands lying in front of North Bay reveals the only exceptional break in all the Laurentian monotony of this district. There, side by side with rocks of the Laurentian sea, we have presented, in clearly defined outlines, substantial evidences of stratified rock formation belonging to what is commonly known as the Trenton period, which is only one of the great sub-divisions of the Palæozic age of the earth's history.

At some time very remote, when this whole region was in the throes of convulsion, when livid streams of molten rock broke forth from beneath, and fire and heat and steam acting in concert aided the work of disintegration, when huge masses of metamorphosed and igneous rock matter were heterogeneously piled into the hills and mountains round about, and when by an unevenly formed subsidence of the earth's crust an immense valley was constituted, now occupied by the waters of Lake Nipissing, amid the wreck of matter and the chaos and confusion that reigned on every hand, a portion of Little Manitou remained undisturbed, retaining in an unchanged condition, in its argillaceous and bitumenous shales and calcareous strata, abundant organic remains of both animal and vegetable life, the internal evidence of its own antiquity.

On Great Manitou Island similar evidences exist, but under somewhat changed conditions. There are outcroppings of stratified rock on both the eastern and the western divisions of the island. That on the eastern part of the island apparently corresponds in strike with the exposure on Little Manitou, but appears to have a slight dip to the south or southwest. The whole area, however, is so obscured with drift and bowlders that neither dip nor strike can be determined with any degree of accuracy.

On the western part of the island, where the principal exposure occurs, the strata have a dip of twenty-two degrees to the southwest, reminding us that during the period of upheaval through which this district passed, Great Manitou by no means fared so well as its sister island.

On the third largest island of the group there are also indications of a stratified formation, but in this case, as in the other referred to, the whole is so covered with drift and rubbish and densely wooded as to render it at present practically indeterminable.

The islands are not only conveniently and pleasantly situated, but are also one of the most delightful and healthful summer resorts in this whole northern region. The student of geology will always find a seasonable visit to these islands a delightful pastime, and will be amply rewarded in being afforded an opportunity of studying some features of geological science seldom experienced, and which assist us materially in correctly interpreting the past history of the earth. Some of the fossils found on the islands are in themselves interesting objects of study, and beautiful illustrations of that wisdom and skill everywhere to be seen in the Creator's work. And while they are important as evidences of past history and assist in determining to some extent the very great age of our world, they are also no less significant in demonstrating the eternity of Him who "before the mountains were brought forth, or ever the earth and the world were formed," from everlasting to everlasting is God.

In contemplating the glory and grandeur of the Creative handiwork, and considering the great antiquity of the world on which we dwell, may we not well adopt the language of inspiration and say: "Great and marvellous are thy works, Lord God Almighty;" "Of old hast thou laid the foundations of the earth."

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The 42nd meeting of the American Association opened at Madison, Wisconsin, on August 17th. The following were the officers of the meeting, new secretaries having to be elected in the case of Sections E and G, Messrs. Hill and Coville being absent on the opening of the meeting: President, William Harkness, Washington, D. C.; Vice Presidents.—A. Mathematics and Astronomy—C. L. Doolittle, South Bethlehem, Pa. B. Physics—E. L. Nichols, Ithaca, N. Y. C. Chemistry—Edward Hart, Easton, Pa. D. Mechanical Science and Engineering—S. W. Robinson, Columbus, O. E. Geology and Geography—Chas. D. Walcott, Washington, D. C. F. Zoölogy—Henry F. Osborn, New York, N. Y. G. Botany—Charles E. Bessey, Lincoln, Neb. H. Anthropology—J. Owen Dorsey, Tacoma Park, Md. I. Economic Science and Statistics—William H. Brewer, New Haven, Conn. Permanent Secretary, F. W. Putnam, Cambridge (office Salem), Mass. General Secretary, T. H. Norton, Cincinnati, Ohio. Secretary of the Council, H. L. Fairchild, Rochester, N. Y. Secretaries of the Sections. A. Mathematics and Astronomy—C. A. Waldo, Newcastle, Ind. B. Physics—W. LeConte Stevens, Troy, N. Y. C. Chemistry—H. N. Stokes, Chicago, Ill. D. Mechanical Science and Engineering—D. S. Jacobus, Hoboken, N. J. E. Geology and Geography—W. H. Hobbs, Madison, Wis. F. Zoölogy—L. O. Howard, Washington, D. C. G. Botany—B. T. Galloway, Washington, D. C. H. Anthropology—Warren K. Moorehead, Xenia, O. I. Economic Science and Statistics—Nellie S. Kedzie, Manhattan, Kan. Treasurer, William Lilly, Mauch Chunk, Pa.

The addresses of the Vice Presidents were delivered before their respective sections in the afternoon, and they were as follows: Vice President Nichols, before Section of Physics; subject, "Phenomena of the Time Infinitesimal." Vice President Dorsey, before Section of Anthropology; subject, "The Biloxi Indians of Louisiana." Vice President Walcott, before Section of Geology and Geography; subject, "Geologic Time as Indicated by the Sedimentary Rocks of North America." Vice President Brewer, before Section of Economic Science and Statistics; subject, "The Mutual Relations of Science and Stock-Breeding." Vice President Osborn, before Section of Zoölogy; subject, "The Rise of the Mammalia." Vice President Doolittle, before Section of Mathematics and Astronomy; subject, "Variations of Latitude." Vice President Bessey, before section of Botany; subject, "Evolution and Classification." Vice President Hart, before Section of Chemistry; subject, "Twenty-five Years' Progress in Analytical Chemistry." Vice President Robinson, before Section of Mechanical Science and Engineering; subject, "Training in Engineering Science."

Vice President Walcott in his address before Section E, Geology, referred to the various estimates that had been made as to the length of geological time, these varying from a minimum of 3,000,000 to a maximum of 1,200,-000,000 years. His own studies, based largely upon the Paleozoic sediments of the Cordilleran area, gave a mean between these. The following table gives the estimated time for each of the larger geological eras:

Cænozoic,	2,900,000
Mesozoic,	7,240,000
Paleozoic,	17,500,000
Algonkian,	17,500,000
Archean,	?
Total,	$45,140,000

He stated his belief in the theory that the deep seas and the continental areas are permanent, and thought that the main outlines of the North American continent were laid down as far back as Archean time. Cambrian sediments on either side of the continent are of such extent as to justify the belief, or rather necessitate the belief, that extensive continental masses were near at hand. Thirty thousand feet of sediment in the Rocky Mountain area, and nearly as much in the Appalachian, were indicative of long lapses of time. The sediments of the Rocky Mountains were deposited over an area of at least 400,000 square miles and probably of 800,000. This area extended from the Gulf of Mexico to the Arctic Ocean.

Many statements were made as to the rate of denudation and deposition of calcareous and mechanical sediments. Estimated at the rate of deposit of calcareous sediments now being formed, it was calculated that about 600,000 years would be required to form a deposit of limestone twenty-two feet in thickness. It was estimated that about 47,000,000 years would be required, at this rate, to form the deposit of calcium carbonate in the Cordilleran area. But reducing this fifty per cent for any possible change of conditions, and then taking off a further twenty-five per cent for special conditions affecting deposition, 16,000,000 years would remain for the accumulation of the calcareous sediments. To this must be added time for mechanical deposits, and putting this at its lowest possible term of 1,500,000 years, we have the 17,500,000 years for the Paleozoic time given above.

Professor Osborn, in addressing Section F upon the rise of the mammalia, dwelt especially upon the methods employed by paleontologists, and upon the broad generalizations that had been made by students of fossil mammals. Among these was the generalization of Marsh, that all early types of mammalia had small brain cavities.

Cope had shown by the growth of the feet that all early types had five toes upon both the fore and hind feet and

that the foot rested upon the sole. He had also shown that while the primitive types possessed cone-shaped teeth, the more differentiated they became the more complex the teeth were. An interesting statement in regard to the dental formulas of various orders was given. Without going into details, it may be said that the speaker argued for the three great groups of mammals,—monotremes, marsupials and placentals,—a common origin far back of Jurassic times, for the three were then plainly differentiated. These classes arose from a promammalian type, which was, in its turn, an offshoot from a still simpler form, a second offshoot from which developed into the reptilian type of life. The horse he considered as originating on the North American continent, and he pointed out the interesting fact that the disappearance of many of the huge forms of mammals that once peopled our western plains seemed co-incident with the introduction of grasses.

Professor Bessey, before Section G (Botany), gave an excellent address upon classification. He pointed out the anomalous fact that while botanists have long recognized that the present scheme of classification was defective, they still adhered to it. Theoretically discarding it, practically they used it. He showed that there may be degradation as well as advancement in evolution, and that what seemed the lowest forms of dicotyledons, from their floral structure, were not necessarily primitive types. He therefore interpolated the apetalous orders of the ordinary classifications among the polypetalæ, as degraded types of polypetalous flowers. He outlined what seemed to him to be a natural classification, considering the Ranunculaceæ as the most primitive flowers. The greatest deviation, therefore, from this type was the highest in organization. He believed that with but little modification the sequence of orders in our modern text books could be used to express the natural relationships of plants. Of course such a scheme as a lineal arrangement was out of the question. He, in common with many others, recognized the Compositæ as the most highly organized of the dicotyledons, and the Orchideæ were placed at the head of the monocotyledons.

In the general session of Thursday evening the retiring president, Professor LeConte, of California, delivered an address upon the "Origin of Mountains." In opening, he defined a mountain as the result of a single earth effort, occupying a short or a very long time, while a mountain range was the result of a succession of earth throes. The thickness of the strata of mountains varies, but it is always great. In the Appalachians the Paleozoic is 40,000 feet thick. The Mesozoic of the Alps is 50,000 feet, and the Cretaceous of California is 20,000 feet. The sediments of the Appalachians thin out to the west to only one or two thousand feet, so that mountains may be considered as lines of exceptionally thick sediments. They are, at the same time, lines of exceptionally coarse sediments. Foldings and faults are also characteristic of these features of the earth, the folds being single or many, and the faults being sometimes of enormous extent. Faults of 20,000 feet occur in our western region. After this general discussion of features, the causes were considered. There are both formal and physical explanations. The first explain the cause from the geologists' point of view, and the second from that of the physicist. The first may explain one or more of the phenomena, but the last must explain all of them. Various illustrations were given of these, and then the formal explanation of facts was taken up. Mountains are born of sea-margin deposits, the loaded sea bottoms inducing sinking of the denuded land surface, and the mountains are formed by lateral crushing and upthrust. He did not believe in the theory of a liquid interior, with a solid crust, stating that a globe as solid as glass or steel would assume the oblate spheroid form, as the result of rotation. He argued at length in favor of the lateral thrust origin of mountains, and examined objections urged against it. He also outlined other theories of mountain origin, and pointed out their defects, declaring, however, his entire willingness to give up his theory whenever any better one had been presented.

THE CORNELL MIXTURE.

BY M. V. SLINGERLAND, CORNELL EXPERIMENT STATION, ITHACA, N. Y.

LAST winter, while experimenting in the making of the different insecticides and fungicides, I succeeded in forming a combination which, at the time, seemed to be an almost perfect panacea for all the insect and fungoid ills that might affect the fruit grower. When it was shown to Professor Bailey he immediately dubbed it "The Cornell Compound or Mixture."

In making the mixture I combined the following well-known insecticides and fungicides: Paris green, kerosene emulsion and Bordeaux mixture. Simple enough, was it not? And what a field of possibilities and probabilities it seemed to cover when the theory of the combination is rightly understood. In the Paris green (which I prefer to London purple, on account of its containing less soluble arsenic, and is thus less liable to injure tender foliage, and still better, the copper of the Paris green gives it noticeable fungicidal properties) we have the best, cheapest and most practicable insecticide for all biting or chewing insects like the codlin moth, the potato beetle, and all the leaf-eating caterpillars and beetles. The kerosene emulsion is also well known as the best, cheapest and most practicable insecticide for general use against all insects which obtain their food by sucking it through slender beaks with which they pierce the tissues of the plant. Familiar examples of this group of insects are the pear psylla, the plant-lice and the squash bug. And finally, the Bordeau mixture, which now ranks first among the fungicides in effectiveness against the worst fungoid diseases, like the apple scab, the potato blight and rot, and the plum and peach fruit rot. One can thus understand what a destructive power there seemed to lurk behind the mask of the Cornell mixture.

Many experimenters have shown that when the Bordeaux and Paris green are combined, the destructive effect of neither is lessened, and we know that the lime of the Bordeaux mixture converts all of the soluble arsenic of the Paris green into an insoluble compound, thus allowing the use of the arsenite at nearly twice the strength usually used without danger to tender foliage. The two are easily combined and are to be recommended for general use.

Attempts have been made to combine the insecticides Paris green for biting insects, and kerosene emulsion for sucking insects, but without success; the arsenite cannot be made to unite satisfactorily with the oily lighter emulsion. I have seen no accounts of any trials to combine the Bordeaux mixture with kerosene emulsion. Such a combination strongly recommends itself to pear growers especially, who have the pear psylla to fight, and who wish to exterminate the scab at the same time. My experiments in this line were suggested by a large pear grower who had these foes to meet.

My Bordeaux and emulsion were made according to the directions which are appended below.* When the directions were carefully followed I found that I could quite readily combine the two in any proportions required, and the resulting mixture remained stable for weeks; and in fact the Bordeaux, as a mechanical mixture, was improved, for the emulsion held the lime in suspension, so that its tendency to settle to the bottom, and thus require con-

stant stirring, was reduced to a minimum. The addition of the Paris green to the Bordeaux before the emulsion was put in did not visibly affect the mixture. Up to this point, therefore, the combination was a success. It now remained to be seen how it would stand a practical test by the ordinary fruit grower in the field. Theoretically, the chances were all in its favor.

However, further experimentation at the Insectary showed that unless the Bordeaux was rightly made, the emulsion would not form a stable combination with it, and in fact sometimes would scarcely mix at all. It was found that the best combination was obtained when the acid copper sulphate solution of the Bordeaux was exactly neutralized by the alkaline lime; the potassium ferrocyanide was the test to determine when this point was reached. Thus, when the Bordeaux was made in the usual way without testing, nine times out of ten the emulsion would not mix with it satisfactorily. Here, then, was the first obstacle to the Cornell mixture,—the difficulty of making it.

In the spring I saw it made and applied on a large scale, with horse power sprayers. As far as the making and application were concerned, it was a success. It worked as easily through the sprayer and nozzle as the Bordeaux alone. But an examination of the trees after the sprayer had passed showed that the mixture had not spread so evenly over the tree as would either of the ingredients alone. And right here, I believe, is the weakest point in the Cornell mixture. The spray was thrown fine enough, but when it struck the trees the minute particles seemed to be drawn together into larger oily drops, leaving considerable areas unwet. There is a tendency in the Bordeaux mixture alone to do this, but it was increased by the oil in the emulsion.

One can easily imagine with what regret I am thus obliged to tear the mask from off my theoretically complete panacea. When first concocted it seemed equal to all that might be claimed for it, and it was thought best to publish it at once; but, realizing that it ought to be first fully tested in a practical manner, it was put into the hands of two or three large fruit growers with the results which I have detailed above. On the whole, the Cornell mixture, *theoretically*, has great possibilities, and in the hands of careful men can be made, but for the ordinary fruit grower or farmer the difficulty of making it will render it impracticable. And when properly made and applied it will be quite effective, each ingredient for the purpose it is intended. But I believe the effectiveness of each ingredient will be greater if they are not applied in combination, but singly. Thus, theoretically, the Cornell mixture has great possibilities, but, besides the difficulty of making, the effectiveness of each ingredient is lessened, and in consequence the practicability of the mixture is as yet doubtful, and I cannot freely recommend it for general use.

*To make the Bordeaux mixture, dissolve six pounds of sulphate of copper in four or five gallons of hot water. Slake four pounds of quick lime in sufficient water to form a thin whitewash and strain this through a gunny sack (burlap) into the copper sulphate solution. Dilute to forty gallons with water, and the mixture is ready for use. When using, it must be kept thoroughly stirred to keep the lime in suspension. The preparation of the mixture in large quantities may be simplified by a test which obviates the necessity of weighing the lime. Keep the mixture thoroughly stirred when the thin whitewash of slaked lime is being poured through the burlap, and add from time to time a drop or two of the commercial potassium ferrocyanide to the mixture. If not enough lime has been added the drop of ferrocyanide will turn to a very dark color the moment it touches the mixture; when enough lime has been added, the ferrocyanide will not change color when it is dropped into the mixture.

To make the emulsion, thoroughly dissolve one-half pound hard or soft soap in one gallon boiling water. While this solution is still very hot add two gallons of kerosene and quickly begin to agitate the whole mass through a syringe or force-pump, drawing the liquid into the pump and forcing it back into the dish. Continue this for five minutes, or until the whole mass assumes a creamy color and consistency which will adhere to the sides of the vessel, and not glide off like oil. It may now be readily diluted with cold rain water, or the whole mass may be allowed to cool when it has a semi-solid form, not unlike loppered milk. This standard emulsion, if covered and placed in a cool dark place, will keep for a long time. In making a dilution from this cold emulsion, it is necessary to dissolve the amount required in three or four parts of boiling water, after which cold rain water may be dded in the required quantities.

CHEMISTRY IN CANE SUGAR MANUFACTURE.

BY J. T. CRAWLEY, SUGARLAND, TEXAS.

During recent years the part played by chemistry in the manufacture of sugar from the sugar cane has become an important one, cane sugar manufacture is older than beet sugar manufacture, but it remained for those interested in the latter to work out the practical and scientific questions that make the industry of such vast importance at the present time. It is only in recent years that the same scientific principles have been applied in tropical countries in the field and in the factory. Important among the recent improvements has been the application of chemistry to the better understanding of the various changes that the raw material may undergo while being converted into refined products.

When the cane is brought from the fields it is weighed, and then, in most cases, is passed between immense iron rollers where the juice is expressed. By recent improvements in mills the per cent of juice actually obtained, has increased from the neighborhood of 65 per cent to from 75 to 80 per cent.

This great improvement has been made of course by the engineer, but it is safe to say that without the aid of the chemist in calling attention to the immense losses in the bagasse these improvements would have been delayed many years.

After expression the juice is either weighed or measured and then the real work of chemistry begins. Because of the changes that the contained sucrose may undergo during subsequent processes the juice is analysed for sucrose, glucose, total solids, ratio of sucrose to glucose and ratio of sucrose to the total solid matter. This gives, by proper calculations, the total amount of the various ingredients entering the factory with the various ratios one to the other. These ingredients with their ratios must be watched very closely to see that impurities are not formed at the expense of the cane sugar. Lime is added to the raw juice for the purpose of neutralizing the acids contained therein, and in order to purge it of many of the impurities that would interfere with the subsequent crystallization of sugar. Here again a strict watch must be kept. An insufficient quantity of lime leaves free acids in the juice and these same acids will act upon the sucrose changing it into glucose, or inverted sugar, during the evaporation of the juice and syrup. Analyses are made of clarified juice, syrup, massecuite, etc., and from these analyses together with the weights of these various products the chemist is enabled to detect any important loss that has been sustained, whether it be chemical or mechanical, and from a scientific examination of the data thus furnished the manufacturer is enabled to so modify the various processes as to get the best results, finally the sugar and molasses are analysed, and thus a complete record is had of the whole process from the entering of the cane to the final output of sugar and molasses. It will thus be seen that the chemist is the book-keeper, so to speak, of the sugar during the process of manufacture, and it is his business to point out losses, and, if possible, suggest remedies. It is a rare case, however, to find a factory in Louisiana where a strict chemical control, such as has here been outlined, is maintained.

The great amount of labor necessary, together with the cost of weighing and measuring apparatus, has prevented the majority of factories from adopting such a complete system as will tell them the efficiency of their work. But in these days of sharp competition the fact is gradually impressing itself that science must not be overlooked, and that it is of vast assistance even where money-making is the only end.

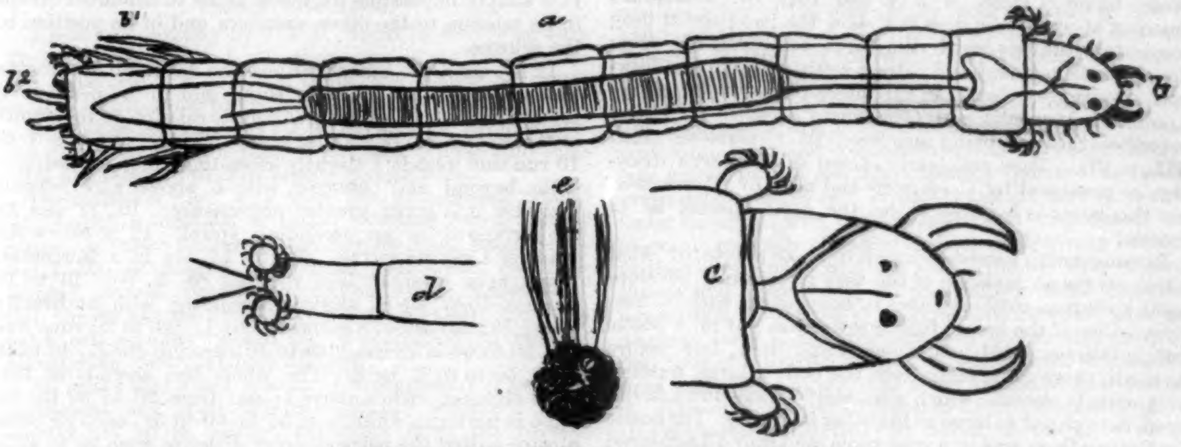
NOTES ON MARINE AND FRESH WATER LARVÆ OF MIDGES.

BY GEO. SWAINSON, F. L. S., ST. ANNE'S-ON-THE-SEA, ENG.

DURING the past two years Professor Miall, F. R. S., has been lecturing before the British Association and elsewhere on "Some difficulties in the life of aquatic insects," and especially instancing the larva of the dipterous fly *Chironomus*. My interest in this lecture when heard at Cardiff was heightened by the fact that I had on three occasions captured a marine larva very closely resembling his *chironomus*. This was included by Dr. Johnston amongst the British Marine Annelids under the name of *Campontia cruciformis*. (*London Mag. of Nat. Hist.*, Vol. 8, p. 179, Nov. 13, 1834, and "Johnston's British Worms."). That *campontia* was a dipterous larva was suspected by both McLeay and Green, the latter because he captured a fresh-water chironomus larva, and noticed its resemblance to *campontia*, and observed its metamorphose into the pupa stage, but the fly escaped him, and this fresh-water genus remained unspecified. This was in 1837, and since that time no one in England seems to have taken the trouble to find out *campontia's* fresh-water relations.

In October last, on our Golf links at St. Anne's-on-the-Sea, I found several larvæ of *chironomus* fully grown in its splendid blood-red color. These I kept during the winter, and watched their metamorphoses in small glass jars, with the tops covered with muslin. They ultimately proved to be *C. dorsalis*, and their resemblance to *Campontia cruciformis* in all but color is most remarkable. The hæmoglobin, which colors the blood plasma in the "Harlequin" larva so beautifully, is replaced in the marine form by a light sea-green pigment with which the fat cells are colored. The mandibles and two pairs of retractible hooked appendages, or pro-legs, are very similar to *C. dorsalis*, and especially the respiratory tubules at the posterior, and I had therefore no doubt as to *Campontia cruciformis* of Johnston being a dipterous larva of the *chironomus* genus. I found this larva several times on the obelia zoöphytes growing at the end of St. Anne's Pier, Lancashire, England. Next I found it on some coryne from the Mumbles, Swansea, and more recently I dredged it from fifteen fathoms depth off Spanish Head, Isle of Man, adhering to seaweed. Dr. Packard, of America, has recorded the discovery of a marine dipterous larva in fifteen fathoms off Salem Harbor, which he has named *Chironomus oceanicus* (see Transactions of Essex Institute, Vol. 6, p. 42). I have carefully compared my specimens with the drawings given by Dr. Packard, and it is quite certain they are not the same species, the mandibles being slightly different, but more particularly the hooklets or retractible claws on both the fore and hind feet are very different, and the respiratory tubules possessed by *campontia* are not visible on the American species.

The great difficulty I experienced in finding any one in England to assist in naming this and other species of chironomus larvæ I have met with, in a large measure prompted me to write this paper. I have applied to many of the principal authorities on diptera, only to find that there are several families in which the life history of only a very few species has been worked out. Surely there are many excellent members of our microscopical societies throughout England who only need to have the fact brought home to them to induce them to make some attempt, however feeble, to fill up this gap, especially as the subject is a very interesting one, and the material abundant. The difficulty of obtaining specialists to undertake the work of describing many groups of insects has been recently referred to by the editor of *Natural Science*, for he states that, though Mr. Whymper's "Travels amongst the Great Andes of the Equator" was completed twelve years ago, the volume in which the zoölogical collection was described, has been only recently issued, and this with several large groups of insects omitted, as no one has been found able to describe them. Professor Miall, to whom I sent my specimens, thought it would ultimately turn out that Johnston's *campontia* was Schiner's *Thalassomyia frauenfeldi*. This may prove to be so, but, again, Schiner only records the capture of the female fly and gives no account of the larvæ in his "Fauna Austriaca" (p. 596, Vol. 2). This species is British, for Mr. H. N. Ridley, of the British Museum, captured both the male and the female flies in a cave in the Isle of Wight (*Entomological Mag.* for 1884), and I think it is the same fly I have seen more than once on our pier end at St. Anne's-on-the-Sea, but did not succeed in capturing them. There is no drawing published yet, I believe, of *Thalassomyia frauenfeldi*. I have twice tried to rear *Campontia cruciformis* in a small salt-water aquarium, but unsuccessfully. It seems quite certain that the larvæ of these diptera do inhabit salt water, for Agassiz speaks of them in the "Cruises of the Blake" as being commonly met with off the North American shores.



CAMPONTIA CRUCIFORMIS (A SUPPOSED ANNELID WORM).

a. Natural size.
b. Magnified.
c. The head slightly compressed between plates of glass.
d. Under side of the anal segment.
e. Hooked sucker foot from Mr. Swainson's microphotograph.

Leaving these species for future identification, I must

now record the discovery of three species of the larva of the fresh-water *chironomus* new to science, and drawings of which accompany these notes, together with that of another new form found only last week by my friend Mr. A. R. Hammond, F. L. S., on the leaves of potamogeton, forming small tunnels therein. I have made a few mounts of all these species, which will very likely prove to be larvæ of well-known species of flies described by Walker and listed by Verrall, there being over 250 different species of chironomidæ in Britain, while the larvæ of only some dozen are known. Up to the present time the best work on these and similar "eucaphalous" larvæ is that of Prof. F. Meinert, published by the Royal Society of Copenhagen in 1886, full of splendid plates of the larvæ only of freshwater species, but it is in Danish, and I do not know that it has been translated. None of these new specimens are included therein, and Mr. Hammond, who is well up in the bibliography (he is now bringing out a paper in the transactions in the Linnean Society and shortly to be published on the structure and life history of *Chironomus dorsalis*, in collaboration with Professor Miall), informs me that he has not met with any drawings or description of these larvæ of mine. I may add that Dr. Johnston's drawing of *campontia* does not show the two pairs of long respiratory tubules which the larva can protrude from the eleventh segment and retract again. These are, however, shown very clearly in the micro-photographs of my mounts of *campontia* and *Chironomus dorsalis*. Mr. Slater describes these as being also seen in *C. plumosis* (Ent. XII., p. 87). They are clearly shown in Meinert's drawings as possessed by *C. plumosis* and also by *C. venustus*, but this latter is believed to be the same species as *C. dorsalis*.

In conclusion, I must not omit to make a note of what I feel sure is an instance of the very interesting development known as *parthenogenesis* in connection with *C. dorsalis*. One of the larvæ, fully grown, was put in a bottle late in October, 1891. It sickened and died, but before its death there came forth from the body a large number of young *C. dorsalis*, which ultimately became fully developed, though not so large as the other imagenes. The bottle containing them was in a cold room, and they all appeared in the winter before the end of February, and so could not possibly be hatched from eggs laid prior to October. I watched these most sedulously through the pupa state, for they spun their pupa cells on the under side of leaves, and not in the mud at the bottom of the glass, like the ordinary *Chironomus dorsalis*, waving their heads about in the curious way described by Meinert. They did not assume the strong, deep, blood-red color either, being nearer the surface of the water. There is no question about the flies being *C. dorsalis*, as I have now one or two in spirits of wine. Finding that Mr. Oscar von Grimm had recorded the fact that the pupa of *chironomus* laid eggs prepared in the body of the larva, these ova being deposited in rows of long threads, just as the female *C. dorsalis* does, only that they are protruded through two small holes above the anus of the pupa. I therefore watched the older non-parthenogenetic blood worms most carefully, when they emerged from the larval into the pupal state, and I must say, that never did the proceeding take place, as far as I could see, and during the following month there were no young larva of *Chironomus dorsalis* produced. It is quite evident that further investigation and the closer watching of the life history of these midges will fully repay entomologists, for it is hardly possible to think, after Mr. Grimm's careful and detailed investigations, that his young larvæ were parthenogenetically produced.

LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

A Space-relation of Numbers.

Mr. D. S. Martin's article under this head, in *Science* for August 11, is of peculiar interest to me in touching upon a mind experience which I had supposed an idiosyncrasy of my own, since I have been unable to find another person who had any similar experience, except my own mother. I am glad to find another person of a like mind, since it is an indication that it may not be an exceedingly rare experience.

I date the origin of my idea at the time when I began to learn to count, which was at home, by the "purely abstract and *memoriter*" system. Not only are the numbers from 1 to 100, but from 1 to infinity, and all the fractions in a less degree, conceived of by me "as holding, relatively, definite positions in space, from which they never vary." It is simply impossible for me to think of a number except in its relation to the other numbers and in its position in the scheme.

In my mind the numerical position bears no relation to that of any other object or thing, nor to the position of my body; but it does bear a definite relation to the points of the compass. Beginning at my feet the numbers 1 to 10 run due west in a slightly ascending line, 10 being a little beyond and above 9, with 5 above and beyond 4 so that it is given greater prominence. 10, 11 and 12 are arranged in an ascending spiral. 12 is above the plane of 1 say six inches. 12 to 15 are in a horizontal plane in a straight line running W. N. W. 15 to 19 changes to W. by S., slightly ascending, with 20 directly above 19, and about 8 inches above 1. 20 to 30 runs due S. 30 to 60 is a zizzag, 30 to 40 running due E., 40 to 50 S. E., 50 to 60 E. by S. The whole line ascends so that 60 is eighteen inches above 1; but from 20 to 55 the incline is uniform, while from 55 to 60 it is enough more abrupt so that the perpendicular distance from 20 to 55 is just equal to that from 55 to 60, 60 being directly above 59. 60 to 70 runs due S., 70 to 100 S. S. E. 100 is twenty inches above 1. In the whole scheme from 20 onward the multiples of ten are elevated a little above the numbers immediately following and preceding, so that they are more prominent. From 1 to 100 the numbers get more and more distant and indistinct, and consequently appear smaller as they increase in value; but the twenties and fifties seem plainer, but not larger, than the others, as though they were in the direct sunlight, and the others partly shaded. From 100 I drop back to 1 and repeat the course for every succeeding hundred.

The hundreds from 100 to 900 (but not with their units and tens) are arranged in a straight line tending W. by S., scarcely if at all ascending. 1,000 is directly above 999. 1,000 to 1,000,000 is an indistinct line curving upwards towards S. E. by E. From 1,000,000 onward the tendency is upward and in a S. W. direction; but here a haze envelops the numbers so that they are ill defined and hard to follow.

I conceive of the numbers as being of the same size, but appearing to vary in size as their value in reverse order on account of their distance from the starting point. Therefore in giving perpendicular distances I have given them as they would appear on a chart and not as actual distances. The sense of the true perspective is perfect.

In the application of this scheme to every day use it is

of inestimable value, since it enables me to add with great facility, and perform any simple mathematical operation with ease and dispatch. I have only to conceive of the numbers before me to be arranged in any required way, as in my scheme in their positions, and they are there without further ado.

As I hinted in the beginning, my mother was the only other person known to me to possess this experience. Hers was a conception of a circle of the numbers from 1 to 100, just the same as my conception of the months of the year. I have repeatedly attempted to make a chart of the scheme as it appears to my mind, but have found it impossible on account of the almost constant change of plane and direction, and the sense of gradually increasing space. I know of nothing that could have given a suggestion of the scheme. The impression came too early to have been suggested by any experience, if there had been one to suggest it.

I add this bit in the hope of further drawing out the discussion of the topic, and I shall look with great interest for further notes. LYNDS JONES.

Oberlin College, Oberlin, Ohio.

ENGLISH ORTHOGRAPHY.

A NEW orthography by J. I. D. Hinds, in *Science* for July 21, is cleverly handled, although some slight inconsistencies have crept in, which, I think, the author has overlooked, in his ardor to reform the present method.

English orthography is far in advance of English pronunciation, and it is a fallacy to make orthography conform phonetically to erroneous pronunciation.

The syllables "tion" and "sion" are pronounced "shun" or "zhun," a mistake or rather a wilful corruption of which no other language deriving its roots from Greek and Latin, is guilty. Now if our "dictionary manufacturers" would prescribe "nati-on" and "provi-si-on" (all vowels but the first short) in their next editions, phonetic orthography would not be compelled to use the abominable "shun" of Josh Billings.

All agree that a new system of orthography (I must be consistent and spell this ortho-graphy, second *o* long) should not be an abrupt departure from the present form. But in the first place let us have *re*-vocable in *pre*-ference (first *e* long) to *rev*-ocable, baro-meters and thermo-meters, as weather-meters, etc., etc.

Mr. Hinds suggests the letter "a" for an intermediate sound of "a" as in last, and also "a" for the short sound of "a" as in mat. I fail to note the difference, unless he pronounces "last" (to use his system) laast.

For the present it would, in my opinion, be pre-ferable to retain the present mode of spelling "mate" and "note," and not "maet" and "noet," not because the latter spelling is less correct, but because the change is too radical. For a like reason th, sh and s should be retained as now in use. It is always necessary to consider the present generation to whom such changes would be burdensome, while the rising generation will naturally adopt any plan we offer them. The dipthong ai as in air is unnecessary as "a" followed by "re" will produce that sound as in "mare," "fare," etc. The letter q may be pronounced kawe, and written without the "u" making "quick" go much "quicker." X is used so much for Latin prefixes that it must be retained for reasons mentioned.

These few suggestions will give printed and written pages a more familiar look, than Mr. Hinds's orthography, and easily read at sight. To show the difference between the plan proposed by Mr. Hinds with the amendments I offer, it is best to use the same stanza:

SOUNDS OF IEVNING.

Swiet waas the sound, hiven oft at ievning's klose
Up yondur hil the villaj murmur rōse,
Thare as I past with kareles steps and slo
The mingling notes kame sofend from below
The swane responsiv as the milk made sung,
The sobur hurd that lode to miet thare yung
The noisi gies that gabbeld o'r the pull
The plaeful children just let luse from skuel,
The wac-dog's vois that bade the hwispring weind,
Etc., etc.

However it is idle to write and talk without taking action in this matter. Let Mr. Hinds, if he is a pedagogue, call a convention of teachers through the valuable medium of *Science*. Nothing but stubborn lethargy and indifference hinder the progress of reformation in this branch of study. European nations are continually improving their languages, but the English-speaking savant is so perfect that he alone uses a capital "I," when writing of himself. Such a character will not change his position unless he receives a violent push. FREDERICK KRAFFT.

238 Palisade Avenue, Jersey City Heights, N. J.

AN IMPORTANT OMISSION AT THE WORLD'S FAIR.

To any thoughtful student of affairs, with sufficient foresight to look fifty years into the future, and who realizes a few of the elementary facts regarding the appalling destruction of our forests, a visit to the beautiful Forestry Building at the World's Fair brings a sense of keen disappointment.

There is displayed, in admirable order and with scientific accuracy, nearly every fact regarding the location, size, form, color and commercial value of every kind of tree grown in the country, carefully painted or photographed specimens of leaf and blossom, and sections of trees, showing girth, bark, polished and unpolished surfaces, all carefully classified and labelled, giving evidence to the thousands of tourists who drift by with a casual glance that a great deal of painstaking work has been done, which doubtless, as a permanent museum, would be of great value to the specialist, but which, with the limited time of a tourist, can be of little value to nine hundred and ninety-nine out of every thousand who will see it. The only general impression to be gathered from all this elaborate multiplicity of detail, at the time of our visit, was that the United States produced a great variety of beautiful trees, some of them of enormous size, and that, for aught one could see, it would always continue to produce such trees in the same quantities that it had done in the past.

Nowhere was there to be found the slightest hint of the fact that we are *annually cutting off twice as much timber as we are producing*. Not a word to call the attention of the thoughtless passer-by to the importance of forests to preserve our water-courses from alternate floods and droughts, to the ruthless destruction of beautiful mountain scenery, to the urgent necessity of setting out trees on our dreary, treeless plains and barren city streets.

"There ought to be something done about it, sure enough," said a good-natured, heavy-bearded man from one of the Pacific States, with whom we earnestly discussed the matter. "I never really thought much about it, and of course it isn't in my line, for my business is destroying trees, as I'm here representing a lumber firm, like most of the others who have exhibits, but I'll take you to Mr. ———, who is in charge, and you can talk to him." Mr. ——— proved very courteous and somewhat interested in the matter, but didn't know what could be done about it, as his superior had given no directions. "But," we protested, "it could not cost more than ten or twenty dollars to put up a large placard headed: 'ATTENTION! FACTS THAT EVERY AMERICAN CITIZEN OUGHT TO KNOW,' and underneath in large, clear type, without confusing figures or statistics, give a few of the most cogent facts

in such simple form that they could be readily remembered. Not one in fifty knows these elementary facts. If this exposition is to have the educative value that it is hoped, it must be largely by providing important information in simple form, for no one can remember the endless data and statistics which are here provided, and if they could, the one most important fact of all, that we are fast approaching an utter destruction of our forests, is nowhere mentioned."

"The trouble is just here," quoth the lumberman, "everybody has got to look out for himself, and what's everybody's business is nobody's business, you know. And then some of those fellers that took up tree claims out west, well, I've known 'em many a time to plant their trees and get their land, and then let 'em all die, or sometimes even root 'em up," he added with an amused smile, as if he found the whole matter rather a good joke. "You see, most folks don't look at it as you do; twenty-five years ahead is a long time; we shan't feel the pinch much before that, and then—well"—then, we mentally continued, when, like Samson, our strength has been shorn from us, when our hills are as barren as those of Palestine, and our rivers can no longer turn the factory wheels, when our population has doubled, and the price of wood sextupled, then our children, waiting for a hundred years, and toiling with infinite cost and pains to replace what we have destroyed, may well say, "Thus are the sins of the fathers visited upon the children even unto the third and fourth generations." And Mr. ——— smiled courteously, and said he should think it would be a good plan if something could be done about it.

LUCIA TRUE AMES.

Boston, Mass.

THE USES OF THE LITTER BY SPARROWS.

[Editor *Science*: The following incident observed by my step-son, twelve years old, may be of interest in connection with the mooted question regarding the use of tools, utensils and weapons by the lower animals. MERWIN-MARIE SNELL.]

A few days ago, as I was walking along the street near a little park, I saw a sparrow lying upon the ground. It fluttered its wings, but was unable to rise.

As I was looking, a pair of old birds came along carrying between them a little bare twig about three inches long. One had hold of one end of it, and its companion had hold of the other. They brought it down to the bird on the ground, and it caught hold of the stick with its beak.

Then they flew up again into a tree, carrying the third bird hanging to the stick, and by this means brought it to a place of safety.

I am not sure that the bird on the ground was a young one; it looked quite large and may have been wounded or sick. It was not able to fly, anyway, for I saw it try to do so without success. All the birds were common English sparrows.

E. STANLEY SPRAGUE.

Chicago, Ill., Aug. 7, 1893.

SPACE RELATION OF NUMBERS.

MR. MARTIN's association of the natural series of numbers with a diagram in space is by no means unusual. As I have a similar association myself I have been interested in the accounts published from time to time by people, most of whom imagine their experiences to be unique. There must by this time be quite a literature of the subject, though I do not know whether any one has kept track of it. I should say, however, that most persons having a strong sense of locality would be apt to associate, not only the series of numbers but also any other series, such as the months of the year or the days of the week, with a space diagram. In my own case the natural numbers begin at my left hand quite close to me and run in a straight line diagonally in perspective into the distance towards the right. Beyond one hundred I can scarcely see them, however. The months of the year are similarly arranged save that the current month is always close to me. Most other series have some sort of space arrangement, the kings of England, for instance, beginning at a distance, and running in a very eccentric curved and zigzag line, finishing near me. I localize almost everything I memorize or think of deeply.

Two localities in particular are associated respectively with the freedom of the will and generalized space, and whenever I think of one of these subjects the corresponding place, with surrounding buildings and scenery, is always vividly present. Of course this is mere association of ideas, but the localization of a numerical series is doubtless nothing more, and I can see no analogy between it and the phenomena of color-hearing, etc., which seem to have for a basis an actual stimulation of two senses by the causes that usually affect only one—probably a purely physiological phenomenon.

It is not necessary to suppose any material basis for the diagram. I used to think that mine arose from my learning my numbers from a set of blocks, which I placed in a row. It seems just as likely, however, that the diagram was wholly imagined, it being easier to remember the numbers when associated with a position in space. It seems likely that many people have these diagrams who do not realize it; I was not always aware of mine till they had been firmly fixed in my mind for many years.

ARTHUR E. BOSTWICK.

Office of The Standard Dictionary, 2 Clinton Hall, Astor Place, N. Y. City.

ROUND WORMS IN THE BRAINS OF BIRDS.

IN reference to the note by Professor G. H. French, in *Science* for June 2, it may be said that many years ago the late Professor Nyman published an article in the Proceedings of the Boston Society of Natural History on a nematoid parasite which lives coiled up in the brain of the anhinga or snake-bird in Florida. The species is *Eustrongylus papillosus* of Diesing. Afterwards, in the Bulletin or Report of Hayden's Geological Survey of the Territories, the volume and year not in my mind at this writing, I described and figured a similar species (*Eustrongylus buteonis*) which was found by a student of mine living under the eyes of *Buteo swainsoni*, while another species (*Eustrongylus chordeilis*, Pack.) was removed from the brain of the night-hawk. These are all referred to in my text book of Zoölogy, p. 169. A. S. PACKARD.

SHARKS IN FRESH WATER.

I HAVE twice noticed extended and circumstantial accounts of the existence, and in great abundance, of genuine sharks in the fresh-water lake of Nicaragua. Though the first account, according to my recollection, appeared in a very reputable publication, I was inclined to think, from the novelty of the idea, that it was merely an invention of some writer who was amusing himself, and filling out an article, but seeing another account by another writer, and even more circumstantial than the first account, I cannot doubt that there is some basis for the statement. If any readers of *Science* know of the occurrence of genuine sharks in fresh water, and especially in the case of the lake above mentioned, I should be glad to have a report to *Science*.

In conversation the other day with one who is a good deal of an authority in such matters, I found that he had no knowledge of any occurrence of sharks in fresh water, but saw nothing unreasonable in the idea. C. H. AMES.

5 Somerset Street, Boston, Mass.

THE many friends of Henry de Varigny, Sc. D., of Paris, France, will be glad to know that he is on the way to this country, having sailed on Aug. 23, being sent by the French government to investigate certain questions connected with the fisheries and applied entomology.

—Corrections: In the letter by Joseph C. Thomson, not Joseph *W.* Thompson, on page 97, for "innovated" read "innervated."

—Charles Scribner's Sons have just ready a little volume of "Stories of the Sea" to match the "Stories of the South," "Stories of New York" and "Stories of the Railway," already published.

EXCHANGES.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For exchange—Complete set of serial slides of embryo chick, 12 to 72 hours old; of rabbit lom long, and various stages of development of tadpole, mouse and rat. Will sell or exchange for botanical slides, or books or photographic apparatus. D. T. MacDougal, University of Minnesota, Minneapolis, Minn.

For sale or exchange.—A fine collection of Lepidoptera, native and exotic. For particulars address Addison Ellsworth, Binghamton, N. Y., care Republican.

For sale or exchange for works on entomostraca, Wolle's "Desmids of the U.S.," Hentz "Spiders of the U. S.," The Amer. Entomologist & Botanist, Vol. 2, The Amer. Entomologist, Vol. 1, Harris's "Insects Injurious to Vegetation," colored plates, copy formerly owned by Townend Glover. C. Dwight Marsh, Ripon, Wis.

"The Conchologist: a Journal of Malacology," Vols. 1 and 2, with wood cuts and plates, value 12 [-will exchange for any works or pamphlets on American Slugs or Anatonry of American Fishes. W. E. Collinge, Mason College, Birmingham, England.

I wish to exchange a New Model Hall Typewriter, price $30, for a Daylight Kodak, 4x5 preferred. George A. Coleman, Dep't. Agric., Div. of Ornithology, Washington, D. C.

Exchange—The undersigned is desirous of obtaining correspondents interested in macro-lipidoptera, in Alaska, the far Western, Southwestern and Southern States. Will also exchange rare lepidoptera for entomological literature. Levi W. Mengel, Reading, Penn.

Wanted to exchange—Medical books, Obstetrical Transactions, London, Works of Sir J. Y. Simpson, Beck's Medical Jurisprudence. Handbook for the Physiological Laboratory, by Burnton, Foster, Klein and Sanderson, Quain's Anatomy, and about fifty others. Catalogues given. Want Geological, Botanical and Microscopical books in exchange. Dr. A. M. Edwards, 11 Washington St., Newark, N. J.

Wants.

I WOULD be grateful to receive replies to any of the following questions.—Is copper found native in Mexico? Is it found native in Cuba? If so, in either or both cases can I purchase authentic specimens? Can any one furnish me with results of analyses of native Mexican or Cuban copper, also analyses of unalloyed copper reduced from the ore from Cuba or Mexico? Is it possible to procure aboriginal implements of copper from Cuba or Mexico? Answers to these questions will greatly aid the preparation of a report for a scientific institution. C. B. Moore, 1321 Locust St., Philadelphia, Pa.

A YOUNG woman who has been an assistant for a literary and scientific man desires a similar position. Is an experienced and accurate stenographer and typewriter, thoroughly educated, and sufficiently familiar with literary work to write, independent of dictation. Has some knowledge of the Spanish language. Will go to any part of the United States. Address, Box 147, Ravenna, Ohio.

A GRADUATE of an American Polytechnic institution and of a German University (Gottingen), seeks a position to teach chemistry in a college or similar institution. Five years' experience in teaching chemistry. Address Chemist, 757 Cary St. Brockton, Mass.

WANTED.—A position as teacher of Biology, by an experienced teacher, a college graduate with four university post-graduate courses in the Sciences. Good endorsements, and eighteen years' experience. Address A. N. Somers, La Porte, Ind.

WANTED.—Assistant in Nautical Almanac office, Navy Department. The Civil Service Commission will hold an examination on August 15 to fill a vacancy in the position of assistant (computer) in the Nautical Almanac office. The subjects will be letter-writing, penmanship, trigonometry, rudiments of analytical geometry and calculus, logarithms, theory and practice of computations, and astronomy. Each applicant must provide himself with a five-place logarithmic table. The examination will be held in Washington, and if applications are filed in season, arrangements may be made for examinations in the large cities. Blanks will be furnished upon application to the Commission at Washington.